

Amendments to the Specification

Please replace paragraph [0011] at page 6, with  
following amended paragraph:

--From prior art it is known ~~The~~ luminescence spectra (Siegel et al., 1985) are much more responsive to trace amounts of impurities and are very selective. At the same time, for identifying components of a mixture, three dimensional luminescence spectra (Webor, 1961) are most appropriate, which spectra reflect the complete set of spectral-luminescent characteristics of the test object. These spectra may be represented both as an isometric projection in coordinates of excitation wave length and irradiation wave length, or contoured spectra, as shown in Figures 1 and 2. Particularly, there is a known method for identifying a petroleum type by contoured luminescence excitation-irradiation spectra (Rho et al., 1978; Corfield et al., 1981). Also, very striking differences are observed for petroleum synthesis products. An illustration of this is found in Figure 1 in which the contoured spectra for various brands of benzene are shown.--

Please replace paragraph [0019] at page 9, with  
following amended paragraph:

--The present invention provides a reagent-free express instrumental method for registering and analyzing electronic optical signatures that are formed during direct measurement of a complex set of photo absorption luminescent and Raman spectral parameters of multi-component mixtures. The complex set of absorption, luminescent and Raman spectral characteristics of an object is its unique identification characteristic. When comparing such set of measurable characteristics for an identifiable sample of an unknown mixture with an electronic digital image that has the same set of characteristics as the control sample of a known mixture, there is no need to identify each component of the mixture, (Nekrasov V.V, et al., pat RU 2150699, bull. No. 16, 2000). That is, the herein claimed method compares the optical spectral signature of a sample comprising a mixture of compounds with that of a reference mixture to detect changes in the mixture composition. This method is suitable for forming dynamic computer-based data banks, making it possible to ~~control~~ monitor the content of industrial products, life support systems, and the environment, as well as to prevent harmful and dangerous contaminations in these systems.--

**Please replace paragraph [0020] at page 10, with following amended paragraph:**

--According to the present invention, the complex responsiveness of objects which are analyzed to the light influence by means of comparing absorption, ~~speetral~~, luminescent, and Raman spectral characteristics of the object being analyzed. These characteristics were obtained while performing relative measurements of characteristics of compounds being identified and characteristics of a standard sample and/or a calibration sample of a known compound by a quasi-double\_beam method ensuring calculation and compensation of systematic and random hardware inaccuracies directly during implementation of comparative measurements and/or with further mathematical treatment of the results.--

**Please replace paragraph [0021] at page 10, with following amended paragraph:**

--A complex analysis using three complementary methods, photo absorption, luminescence, and Raman scattering, promotes increasing responsiveness and selectivity of the method (Beyermann, 1982). The high express degree of analysis is secured by obtaining the complete set of absorption, ~~spee-~~  
~~tral~~ and luminescent, and Raman spectral characteristics during the united analytical cycle of measuring and comparing the characteristics of samples under comparison in each of the

selected points of the specific analytical range in one specialized analytical device, and/or while comparing the measured characteristics of a sample being identified in an unknown mixture with the electronic signature of a standard sample of a known mixture.--

**Please replace paragraph [0022] at page 11, with following amended paragraph:**

--Measurements of transmitted or reflected light are executed using standard methods, such as those shown in Weber, 1961 and Rabek, 1982. Intensity of luminescent ~~radiation~~  
light radiated by a sample is measured in accordance with methods described by Lakowicz, 1983; Parker, 1968; and Rabek, 1982. At the same time, measurements are performed for intensity values of the exciting light  $I_{0i}$  at the excitation wavelength  $\lambda_j$ , and the intensity values of signals being measured are normalized for this value. Calculation and compensation of the light transfer ratio for an optical path of the registering and measuring apparatus are performed by means of the procedure of relative measurements of intensity values for the sample being identified and a standard sample and/or specially prepared calibration sample of luminescent mixtures of a certain, strictly unchangeable compound with stable by time spectral and luminescent characteristics.--

Please replace paragraph [0025] at page 12, with following amended paragraph:

--FIG. 3 is a block diagram of a specialized analytical device (a) and diagram of switching positions of samples when measuring the intensity values of the probing light  $I_0$  (b), the passing light  $I_T$ , and the luminescent light  $I_L$  (or the Raman scattering  $I_R$ ) for a standard sample of a known mixture  $K$  (c) and a sample being identified of an unknown compound  $U$  (d):

LS - a light source,

$\lambda_i$  SM - a device for ~~extracting~~selecting the monochromatic probing irradiation,

$F_1$  - a device of focusing the probing ray (step A);

SH - a holder of samples with a device for replacing a standard sample and a sample being identified in the analytical channel (step B):  $K$  is a standard sample of a known mixture,  $U$  is a sample being identified of an unknown compound;

$F_{2,3}$  - devices for gathering the probing light  $I_0$ , the passing light  $I_T$ , and the luminescent light  $I_L$  - step C (or the Raman scattering  $I_R$ ), to photo-detector devices,

$\lambda_j$  SM - a device for ~~extracting~~selecting the luminescence wavelengths (or the Raman scattering  $I_R$ ),

$PD_1$ ,  $PD_2$  - photo-detector devices for measuring the intensity

values, accordingly, for the probing light and the passed light, and the luminescent light (step D) or the Raman scattering;

R&RM - a module of registration and treatment of signals (steps E-G) including power and control units (remote control) of execution units, and a module of communication with an external computing device and/or a device for displaying the analysis results.--

**Please replace paragraph [0028] at page 14, with the following amended paragraph:**

--a. Light from a wide-band source of optical radiation is divided into spectral components, and/or the assigned sections of monochromatic light ~~with~~within a spectral width of  $\Delta i$  are extracted from this light in the selected range of wavelengths  $\lambda i$  while ensuring the possibility of changing the spectral position of these sections with the assigned pitch  $\Delta \lambda i \geq \Delta i$ . The extracted monochromatic light is then focused ~~onto~~into a probing beam having a specified geometric shape, and the light is directed onto a sample under analysis;--

**Please replace paragraph [0032] at page 15, with following amended paragraph:**

--e. The relative intensity of the gathered light passing through a sample, or reflected by a sample, is defined at each of extracted wave-lengths  $\lambda_m$ , and the luminescent light for each of the extracted wave-lengths  $\lambda_m$ ,  $\lambda_n$  for a known mixture and unknown mixture, in accordance with the following expressions:

$$T^K(\lambda_m) = \frac{I_T^K(\lambda_m)}{I_0^K(\lambda_m)}; \quad T^U(\lambda_m) = \frac{I_T^U(\lambda_m)}{I_0^U(\lambda_m)};$$

$$L^K(\lambda_m, \lambda_n) = \frac{I_L^K(\lambda_m, \lambda_n)}{I_0^K(\lambda_m)}; \quad L^U(\lambda_m, \lambda_n) = \frac{I_L^U(\lambda_m, \lambda_n)}{I_0^U(\lambda_m)}, \text{ where}$$

$I_T^K(\lambda_m), I_T^U(\lambda_m)$  - intensity values of passing or reflected light for samples of a known  $K$  mixture and an unknown  $U$  mixture measured within the specified sections  $\lambda_1, \lambda_2, \dots \lambda_m$  of the extracted range of wave-lengths of incident radiation  $\lambda_i$ ;

$I_L^K(\lambda_m, \lambda_n), I_L^U(\lambda_m, \lambda_n)$  - intensity values of the luminescent ~~irradi-~~  
~~ated~~ light radiated by a sample of a known  $K$  mixture and a sample of an unknown  $U$  mixture within the specified sections  $\lambda_1, \lambda_2, \dots \lambda_n$  of the extracted range of wave-lengths  $\lambda_j$  with light excitation within the specified sections  $\lambda_1, \lambda_2, \dots \lambda_m$  of the extracted range of wave-lengths  $\lambda_i$ ;

$I_0^K(\lambda_m), I_0^U(\lambda_m)$  - intensity of incident probing radiation falling on the appropriate samples at the time of performing measurements;--

Please replace paragraph [0033] at page 16, with following amended paragraph:

--f. The corresponding relative intensity values of the light passing through a sample, or reflected by a sample, on each of extracted wave-lengths  $\lambda_m$ , and the luminescent light for each of the extracted wave-lengths  $\lambda_m$ ,  $\lambda_n$  for a known mixture and an unknown mixture are compared, and the ~~compliance~~-correlation between the unknown mixture and the certain mixture is defined by the following expression:

$$A = \frac{1}{2} \times \left( \frac{1}{m} \times \sum_{m=1}^m \frac{T^U(\lambda_m)}{T^K(\lambda_m)} + \frac{1}{m \times n} \times \sum_{m=1}^m \sum_{n=1}^n \frac{L^U(\lambda_m, \lambda_n)}{L^K(\lambda_m, \lambda_n)} \right) = 1 \pm \delta, \text{ where}$$

$T^K(\lambda_m), T^U(\lambda_m)$  - intensity values of passing or reflected light for samples of a known  $K$  mixture and unknown  $U$  mixture, normalized for the intensity of incident radiation falling on a sample at the corresponding wave-length;

$L^K(\lambda_m, \lambda_n), L^U(\lambda_m, \lambda_n)$  - intensity values of the luminescent light radiated ~~irradiated~~ by a sample of a known  $K$  mixture and unknown  $U$  mixture within the specified sections  $\lambda_1, \lambda_2, \dots \lambda_n$  of the extracted range of wave-lengths  $\lambda_j$  with light excitation within the specified sections  $\lambda_1, \lambda_2, \dots \lambda_m$  of the extracted range of wave-lengths  $\lambda_i$ , normalized for intensity of incident radiation falling on a sample at the corresponding wavelength;  $m, n$  - a number of extracted sections with the wave-lengths

under compared within the selected spectral ranges  $\lambda_i$  and  $\lambda_j$ , accordingly;

$\delta$  - a value of allowable deflections of the compared values for the unknown mixture being identified from the corresponding values for the similar values of a standard sample of a known mixture;--

**Please replace paragraph [0036] at page 18, with following amended paragraph:**

--a. Calibration samples  $Q$  are prepared, which calibration samples represent a specially made-up mixture or multi-component solution ~~solutions of a strictly identical constant compound~~, the absorption or reflectance spectra, and luminescence spectra of which solution are overlapped with the corresponding spectra of a certain mixture within the selected analytical spectral ranges  $\lambda_i$  and  $\lambda_j$ , i.e. have nonzero intensity in the specified ranges;--

**Please replace paragraph [0039] at page 18, with following amended paragraph:**

--d. An electronic absorption-luminescent signature  $ALS_k$  of a standard sample is created as follows:

$$ALS_K = \|K_E\| = \left\| \begin{pmatrix} \frac{T_1^K}{T_1^Q} \end{pmatrix} \begin{pmatrix} \frac{L_{1,1}^K}{L_{1,1}^Q} \end{pmatrix} \dots \begin{pmatrix} \frac{L_{1,n}^K}{L_{1,n}^Q} \end{pmatrix} \right\|, \text{ where:}$$

$$\begin{pmatrix} \frac{T_m^K}{T_m^Q} \end{pmatrix} \begin{pmatrix} \frac{L_{m,1}^K}{L_{m,1}^Q} \end{pmatrix} \dots \begin{pmatrix} \frac{L_{m,n}^K}{L_{m,n}^Q} \end{pmatrix}$$

$T^K(\lambda_m), T^Q(\lambda_m)$  - intensity values of passing or reflected light for a sample of a known  $K$  mixture and a sample of a calibration  $Q$  mixture, standardized for intensity of incident radiation falling on a sample at the corresponding wave-length;

$L^K(\lambda_m, \lambda_n), L^Q(\lambda_m, \lambda_n)$  - intensity values of the luminescent light ~~irradiated~~ radiated by a sample of a known  $K$  mixture and a calibration  $Q$  mixture within the specified sections  $\lambda_1, \lambda_2, \dots \lambda_n$  of the extracted range of wave-lengths  $\lambda_j$  with light excitation within the specified sections  $\lambda_1, \lambda_2, \dots \lambda_m$  of the extracted range of wave-lengths  $\lambda_i$ , normalized for intensity of incident radiation falling on a sample at the corresponding wave-length;--

**Please replace paragraph [0049] at page 22, with following amended paragraph:**

--d. The relative intensity of the gathered light of Raman scattering at each of the extracted frequencies  $\nu_1, \nu_2, \dots, \nu_p$  for a known and unknown mixtures is defined in accordance with the following expressions:

$$R^K(\nu_{ex}, \nu_p) = \frac{I_R^K(\nu_{ex}, \nu_p)}{I_{ex}^K}; \quad R^U(\nu_{ex}, \nu_p) = \frac{I_R^U(\nu_{ex}, \nu_p)}{I_{ex}^U};$$

where:

$I_R^K(\nu_{ex}, \nu_p), I_R^U(\nu_{ex}, \nu_p)$  - intensity of Raman scattering ~~irradiated~~  
radiated by a sample of a known  $K$  mixture and a sample of an  
unknown  $U$  mixture within the specified sections  $\nu_1, \nu_2, \dots \nu_p$  of  
the extracted frequency range  $\nu_r$  with light excitation at one  
of the selected frequencies  $\nu_{ex}$ ;

$I_{ex}^K, I_{ex}^U$  - intensity of the exciting light falling on  
corresponding samples at the time of performing measurements;-